Occupational risk deriving from mycotoxin contaminated environment: an update

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OCCUPATIONAL EXPOSURE TO MYCOTOXINS

- ✓ Occupational exposures to mycotoxins are supposed to be very frequent but rarely reported in the scientific literature.

- ✓ Exposure to mycotoxins was shown in animal production and food processing sectors confirming that occupational exposure can be non negligible.

Autrup 1981; Brera et al., 2002; Halstensen et al. 2006; Mo et al., 2014

- ✓ It is of extreme importance to characterize the mycotoxins exposure:
  - ❖ Identify the mycotoxins related to each setting
  - ❖ Concentration
  - ❖ Duration
  - ❖ Factors that may influence the exposure.

PUBLISHED DATA

- ✓ Extensive search was performed to identify scientific papers, available in different scientific databases (PubMed and Web of Science).
- ✓ Fifteen papers were found between the years of 1981 and 2017 reporting occupational exposure to mycotoxins.
- ✓ After 2000 the number of papers increased and the focus changed from studying one mycotoxin to several mycotoxins in the same sample.
- ✓ All the studies demonstrated the presence of mycotoxins in workplace environments and that there was the possibility for the workers being exposed to mycotoxins through inhalation.

Viegas et al. to be published

CRITICAL OCCUPATIONAL SETTINGS FOR MYCOTOXINS PRESENCE

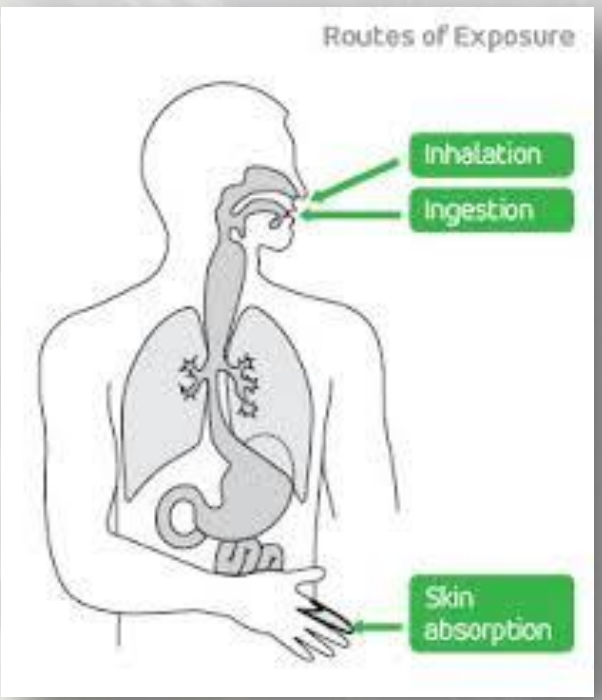
- **Occupational contexts with high and diverse fungal contamination constitutes an important risk of exposure to mycotoxins.** These workplaces should be targeted for mycotoxin exposure assessment.

  - ✓ Feed industry due to raw material processed or stored.
  - ✓ Animal production due to feed and animal density.
  - ✓ Waste industry due to permanent availability of nutrients.
  - ✓ Specific food industry with products contaminated with fungi, such as coffee, onions and other like sugar, grain products, spices and nuts.

Viegas et al., 2015

POSSIBLE EXPOSURE ROUTES

- ✓ Inhalation and dermal (occupational settings)
- ✓ Ingestion (food consumption)



WHAT PROMOTES OCCUPATIONAL EXPOSURE?

- ✓ Mycotoxins exposure occurs during tasks involving **high exposure to organic dust**.

Viegas et al., 2012-2016

- ✓ **Dermal absorption** can occur in settings where the workers use short clothes and large skin areas are exposed allowing dust deposition, or even, when hands are in contact with solutions containing mycotoxins.

Boonen et al., 2012; Viegas et al., 2016

PREVIOUS STUDIES

- ✓ Occupational settings with high fungi diversity and high contamination with organic dust.

International Journal of *Environmental Research and Public Health*

MDPI

Article

Slaughterhouses Fungal Burden Assessment: A Contribution for the Pursuit of a Better Assessment Strategy

Carla Viegas [1,2,*], Tiago Faria [1], Mateus dos Santos [1], Elisabete Carolino [1], Raquel Sabino [1,3], Anita Quintal Gomes [1,4] and Susana Viegas [1,2]

PREVIOUS STUDIES

- ✓ Occupational exposure to aflatoxin B_1 (AFB_1) found in animal production (swine and poultry), slaughterhouses and waste management.
- ✓ Higher exposure found in the waste management setting.

Ann. Occup. Hyg., 2014, 1–9
doi:10.1093/annhyg/meu082

BOHS
The Chartered Society for Worker Health Protection

Assessment of Workers' Exposure to Aflatoxin B1 in a Portuguese Waste Industry

Susana Viegas[1,2*], Luisa Veiga[3], Paula Figueiredo[3], Ana Almeida[3], Elisabete Carolino[1] and Carla Viegas[1]

PREVIOUS STUDIES

Dermal intake can be also an important exposure route in poultry slaughterhouses.

Viegas et al., 2012-2016

Ann. Occup. Hyg., 2015, 1–8
doi:10.1093/annhyg/mev077

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Occupational Exposure to Aflatoxin B1 in a Portuguese Poultry Slaughterhouse

Susana Viegas[1,2*], Luísa Veiga[3], Ana Almeida[3], Mateus dos Santos[1], Elisabete Carolino[1] and Carla Viegas[1,4]

PREVIOUS STUDIES

More recent – Multibiomarker approach

- ✓ In waste management it was found exposure also to other two mycotoxins: Enniatin B and Ochratoxin A.
- ✓ Probably food consumption has also an important role.

Viegas et al., 2017

Mycotoxin Research
https://doi.org/10.1007/s12550-017-0302-1

ORIGINAL ARTICLE

CrossMark

Enniatin B and ochratoxin A in the blood serum of workers from the waste management setting

Susana Viegas[1,2] · Bernd Osteresch[3] · Ana Almeida[1] · Benedikt Cramer[3] · Hans-Ulrich Humpf[3] · Carla Viegas[1,2]

RELEVANT ASPECTS TO CONSIDER IN OCCUPATIONAL EXPOSURE TO MYCOTOXINS

- ✓ **Absence of OELs** for mycotoxins (exposure occurs essentially by inhalation).
- ✓ These compounds are **rarely monitored** in occupational environments.
- ✓ Even if the mycotoxin concentration in a product or material is low, the handling of high amounts can cause an **elevated mycotoxin concentration** in a specific moment or task, that endures depending on how the tasks are developed.
- ✓ **Peak exposures** during specific tasks. Level of exposure can greatly vary between the different tasks within the same industry.
- ✓ Exposure is frequently characterized by a **co-exposure to several mycotoxins**.
- ✓ **Fungi** are often used as an indirect indicator of **mycotoxins presence**. **This approach is incorrect** since mycotoxins can be present in the environment long after fungal elimination and not all fungi produce mycotoxins.

Mayer, 2015 in Viegas et al., 2015; Viegas 2012-2016

TASKS THAT CAN INVOLVE HIGHER EXPOSURE

ONGOING STUDIES

Multibiomarker approach

- ✓ Cork Industry (n= 19)
- ✓ Artisanal Bakeries (n=24)
- ✓ Industrial Bakerie (n=21)
- ✓ Swine (n=25)






COMMON FEATURES

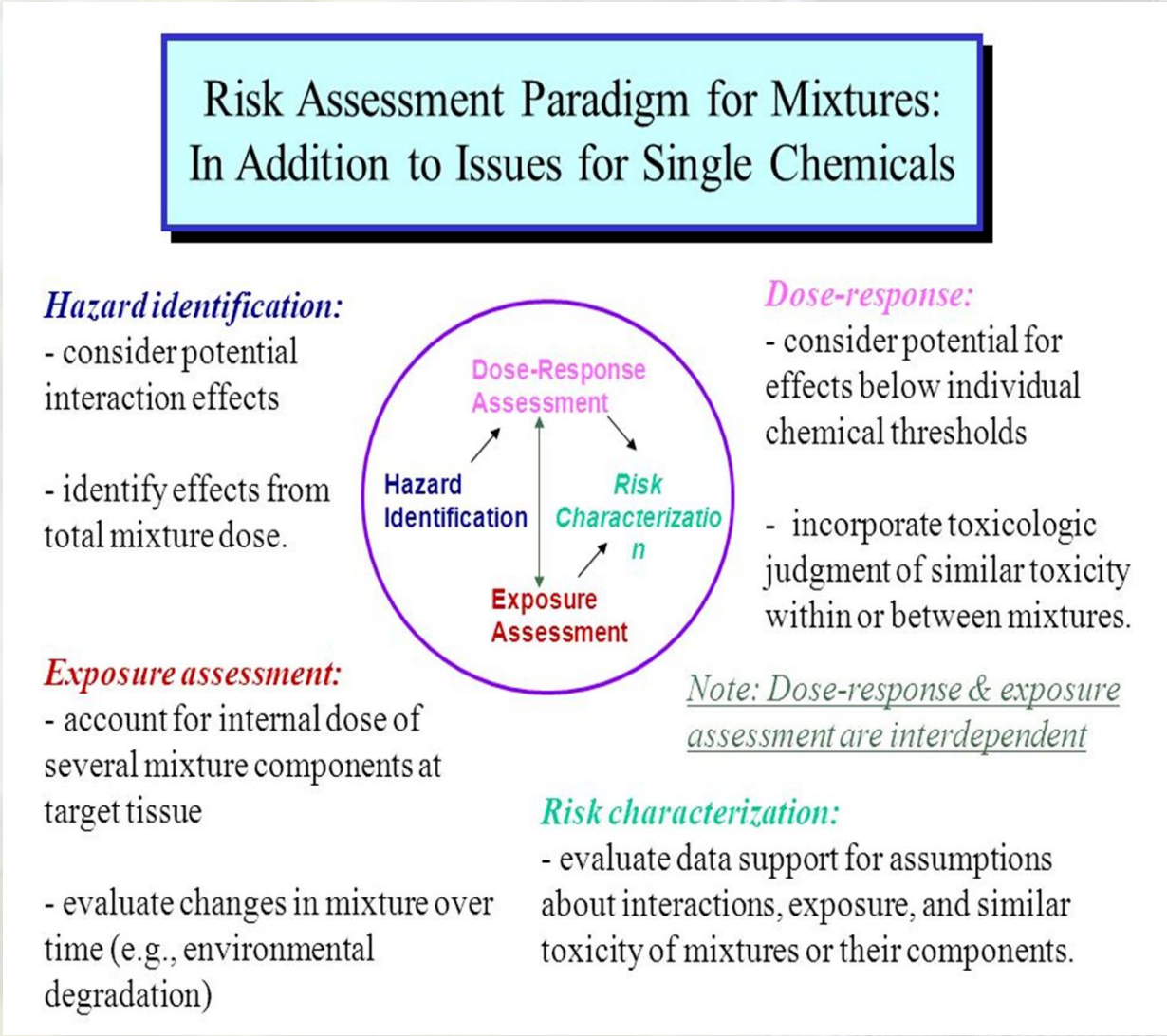
JOURNAL OF OCCUPATIONAL AND ENVIRONMENTAL HYGIENE
2017, VOL. 14, NO. 10, 771–785
https://doi.org/10.1080/15459624.2017.1334901

Aspergillus spp. prevalence in different Portuguese occupational environments: What is the real scenario in high load settings?

Carla Viegas[a,b], Tiago Faria[a], Liliana Aranha Caetano[a,c], Elisabete Carolino[a], Anita Quintal Gomes[a,d], and Susana Viegas[a,b]

CONCLUSIONS UNTIL NOW

- ✓ Need of **recognizing mycotoxins as occupational risk factor**. Mycotoxins should be included for occupational biomonitoring programs.
- ✓ Multibiomarker approach generates important data to perform exposure assessment – **Real life exposure scenario = co-exposure to several mycotoxins.**
- ✓ Multibiomarker approach allows identifying the **most common mixtures present and what substances interactions should be studied.**



EPA, 1992

CHALLENGES TO TACKLE FOR FURTHER RESEARCH

- ✓ **What mycotoxins and mixtures to consider** in the different occupational settings?
- ✓ Even at low levels (food consumption contribution) can we expect negative health effects due to **mycotoxins interactions?**
- ✓ Challenges related with the lack of toxicokinetic data for some mycotoxins generating several additional questions. **Not a straight line!!**
- ✓ What to expect regarding **peak exposures? The same toxicokinetic?**
- ✓ **Climate changes will also affect exposure in occupational settings!**

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THANK YOU!